

Nasua nasua.

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Nasua nasua (Linnaeus, 1766)

Brown-nosed Coati

- [*Viverra*] *nasua* Linnaeus, 1766:64. Type locality "America." Restricted to "Pernambuco, Brazil" by Hershkovitz (1959).
- [*Nasua*] *nasua*: Storr, 1780:35. First use of current name combination.
- [*Viverra*] *quasje* Gmelin, 1788:87. Type locality "Surinami."
- Nasua rufa* Geoffroy St.-Hilaire, 1803:85. Type locality "L'Amerique."
- Nasua pusillus* Geoffroy St.-Hilaire, 1803:87. Type locality "L'Amerique meridionale," restricted to French Guiana by Desmarest (1804:15).
- [*Nasua*] *spadicea* Olfers, 1818:227. Type locality "Brasilien, Paraguan, Neuspanien." Restricted to Paraguay by Hershkovitz (1959:352).
- [*Nasua*] *obfuscata* Olfers, 1818:227. Type locality "Brasilien."
- [*Nasua*] *mondé* Olfers, 1818:227. Type locality "Brasilien."
- [*Nasua*] *minor* Olfers, 1818:227. Type locality "Brasilien."
- Nasua sociabilis* Schinz, 1821:199. Type locality "in Brasilien."
- Nasua solitaria* Schinz, 1821:199. Type locality "in Brasilien." Restricted to "Morro d'Arara, Rio Mucuri, state of Bahia, Brazil," by Avila-Pires (1965).
- [*Nasua*] *socialis* Wied-Neuwied, 1826:283. Type locality restricted to "Morro d'Arara, Rio Mucuri, state of Bahia, Brazil," by Avila-Pires (1965). Renaming of *N. sociabilis* Schinz, 1821 (Allen, 1916c).
- Nasua coati* Blainville, 1841 12(1):32. Type locality unknown, but probably French Guiana (Hershkovitz, 1959).
- Nasua monachus* Smith, 1842:220. Type locality not mentioned.
- Nasua monticola* Schinz, 1844:310. Type locality "Peru."
- Nasua leucorhynchus* Tschudi, 1845:100. Type locality not known.
- Nasua vittata* Tschudi, 1845:100. Type locality "Innern von Guyana." (=near Mt. Roraima).
- [*Nasua*] *montana* Tschudi, 1845:102. Type locality Umanpuquio, 2500 m, "Ceja-region," Peru.
- Nasua dorsalis* Gray, 1866:169. Type locality "South America." Restricted to (eastern) Peru and Ecuador by Thomas (1912).
- Nasua quichua* Thomas, 1901:248. Type locality "Jima, Central region of Cordilleras, Province of Azuay, Ecuador. Altitude 2480 m."
- Nasua phaeocephala* Allen, 1904:334. Type locality "Suapure, Caura district, [Bolívar], Venezuela."
- Nasua candace* Thomas, 1912:228. Type locality "Medellin, Antioquia, Colombia."
- Nasua manium* Thomas, 1912:229. Type locality "Balzar Mts., N.W. of Guayaquil, Western Ecuador."
- Nasua judex* Thomas, 1914:57. Type locality "Bogota," Colombia.
- Nasua gualeae* Lönnberg, 1921:30. Type locality Gualea, Ecuador.
- Nasua henselii* Lönnberg, 1921:102. Type locality Santa "Catharina, S. Brazil." Lönnberg entitled the species description "*henseli*" (1921:102), but this appears to be a misspelling as "*henselii*" is used throughout his paper.
- N. n. boliviensis* Cabrera, 1956:3. Type locality "Palmar, provincia de Chaparé, departamento de Cochabamba, Bolivia, a 1.500 m de altitud."
- N. n. candace* Thomas 1912:228, see above. Current name combination first used by Allen 1916b:221 (*judex* Thomas is a synonym).
- N. n. dorsalis*: Gray, 1866:169, see above. Current name combination first used by Cabrera, 1956:3 (*jivaro* Thomas, *juruaana* Ihering, *söderströemmii* Lönnberg, and *mephisto* Thomas are synonyms; Cabrera, 1958).
- N. n. manium*: Thomas, 1912:229, see above. Current name combination first used by Allen 1916a:121 (*gualeae* Lönnberg is a synonym).
- N. n. montana*: Tschudi, 1845:102, see above. Current name combination first used by Cabrera, 1956:3 (*monticola* Schinz is a synonym, but apparently has priority over *montana*).
- N. n. nasua*: Linnaeus, 1766:64, see above. Current name combination first used by Vieira 1945:410 (*coati* Blainville, *mexicana* Hagmann, *minor* Olfers, *monde* Olfers, *obfuscata* Olfers, *pusillus* Geoffroy St.-Hilaire, *quasje* Gmelin, and *rufa* Geoffroy St.-Hilaire are synonyms; Cabrera, 1958).
- N. n. quichua*: Thomas, 1901:248, see above. Current name combination first used by Allen 1916a:122.
- N. n. solitaria*: Schinz, 1821:199, see above. Current name combination first used by Allen 1916c:573 (*sociabilis* Schinz, *socialis* Wied-Neuwied, and *henselii* Lönnberg are synonyms).
- N. n. spadicea*: Olfers, 1818:227, see above. Current name combination first used by Hershkovitz 1959:352 (*aricana* Vieira and *cinerascens* Lönnberg are synonyms; Hershkovitz, 1959).
- N. n. vittata*: Tschudi, 1845:100, see above. Current name combination first used by Cabrera, 1958:248 (*dichromatica* Tate and *phaeocephala* Allen are synonyms; Cabrera, 1958).
- The names *aurea* Lesson and *monachus* Smith have not, as yet, been allocated to subspecies.

DIAGNOSIS. *Nasua nasua* (Fig. 1) differs from *N. narica*, its only congener, by pelage on the muzzle that is brown or gray and hairs on the neck that are in a reversed anterior position. The palate is flat along the midline, rather than concave as in *N. narica* (Fig. 2). The sides of the nasal bones converge posteriorly rather than being parallel, and the postorbital process of the jugal bone is present. The entoconid on m2 is absent. The



FIG. 1. Adult female *Nasua nasua* from the Caetetus Reserve, São Paulo, Brazil. Additional band members are in the background. Photo by A. Keuroghlian.

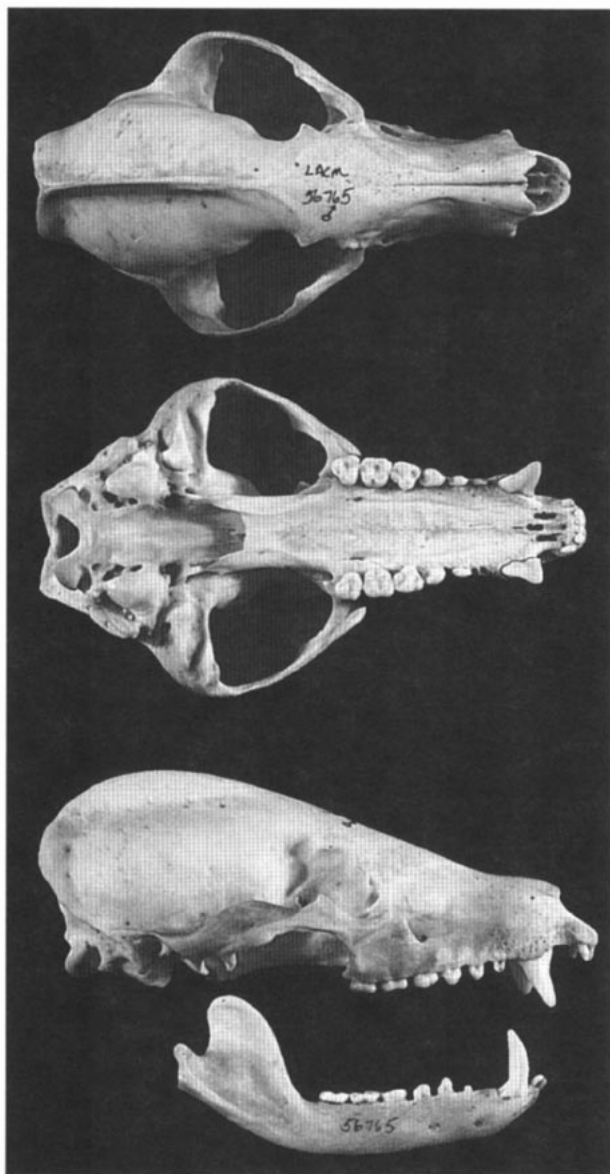


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Nasua nasua* (male, Los Angeles County Museum 56765). Greatest length of cranium is 129 mm.

distal tip of the baculum is spatulate rather than bilobed (Decker, 1991). The baculum is shorter than that of *N. narica* and possibly of *Nasuella olivacea* (Decker, 1991; Mondolfi, 1987; Pocock, 1921). The diagnostic utility of length of the baculum is ambiguous, however, as baculum size has not been sampled over the entire geographic range (Decker, 1991). The calcaneus can be differentiated from that of *Nasua narica* by the smaller ratio of the length of the posterior articular surface to the total length, a more smoothly curved posterior articular surface, a knob-like trochlear process, and a less distinct groove on the edge of the trochlear process (Stains, 1973). *N. nasua* has a single major hemoglobin as opposed to the two hemoglobins found in *N. narica* (Brimhall et al., 1977; Seal, 1969).

Much of the taxonomic confusion regarding the recognition of *N. narica* and *N. nasua* versus solely *N. nasua* (Corbet and Hill, 1986; Honacki et al., 1982) may be traced to errors in interpretations of statements originally made by Cabrera (1958—Decker, 1991). The proliferation of *Nasua* species is due to taxonomic splitting based primarily on pelage color variation, highly variable cranial characters, and misunderstandings of the social structure (Allen, 1879; Cabrera, 1956; Decker, 1991).

GENERAL CHARACTERS. Brown-nosed coatis are a mid-

sized species with a long, slender tail equal in length to head and body and often held vertically erect during foraging. The tail is not prehensile. The brown-nosed coati also has an elongated rostrum, terminating in a flexible rhinarium that protrudes beyond the end of the lower mandible. The claws are long, the feet plantigrade, soles naked. Ears are short. The canines are blade-like, and the premolars and molars have comparatively high crowns with sharp cusps (Emmons, 1990; Husson, 1978; Redford and Eisenberg, 1992).

Average external measurements (in mm) of five adult males (mean ± 1 SD) and one female *N. n. vittata*, respectively, from Suriname are as follows: length of head and body, 532.0 ± 36.1 , 525; length of tail, 444.5 ± 20.8 ($n = 4$ males), 430; length of hind foot (female without claw), 93.6 ± 1.5 , 83; length of ear, 40.0 ± 1.6 , 40; body mass (in g), $3,863 \pm 652$ ($n = 4$ males), 3,000. Average cranial measurements (in mm; mean ± 1 SD) for two males and three females, respectively, from Suriname are as follows: greatest length of skull, 121.7 ± 4.0 , 112.5 ± 3.6 ; condylobasal length, 115.8 ± 3.5 , 106.4 ± 4.2 ; zygomatic breadth, 65.9 ± 2.1 , 55.1 ± 3.1 ; length of mandible ($n = 3$ males), 85.0 ± 2.3 , 78.8 ± 3.9 (Husson, 1978). Average external and cranial measurements (in mm; mean ± 1 SD) of seven adult males and three adult females, respectively, from Mato Grosso and Para, Brazil (*N. n. nasua* and *N. n. spadicea*) are as follows: length of head and body, 640.0 ± 57.2 , 531.0 ± 18.5 ; length of tail, 491.7 ± 38.0 , 407.3 ± 12.7 ; greatest length of skull, 129.9 ± 2.3 , 116 ± 6.1 ; length of mandible, 91.6 ± 1.5 , 84.3 ± 0.6 ; zygomatic breadth, 70.9 ± 7.3 , 62.7 ± 1.5 (Vieira, 1945). Twelve males and 13 females (including adults and subadults) collected from Yuquí hunters of Amazonian Bolivia between February and May had mean weights of 4.6 (range, 1.5–6.5) and 4.1 (2.7–5.0) kg, respectively (Redford and Stearman, 1993).

Extensive variations in *N. nasua* pelage coloration are reported throughout their range (Emmons, 1990; Husson, 1978; Redford and Eisenberg, 1992). Breeding experiments show that even within a litter, pelage coloration of individuals is variable (Taibel, 1958). The usual color is orangish or reddish to dark brown, often overlaid with some yellow. The snout is uniformly dark brown to black, with the front having more yellow hairs, thereby giving a grizzled pattern. White spots are found above, below, and behind the eye. The outside of the ear is dark, inside whitish. The neck is yellowish, leading to underparts of white or yellowish to light brown. Feet are dark brown to black. The tail is colored like the dorsum in reddish or dark brown to black and annulated with yellow or light brown. The ring pattern of the tail may be scarcely visible (Emmons, 1990; Husson, 1978; Redford and Eisenberg, 1992).

DISTRIBUTION. *Nasua nasua* is found from Colombia and Venezuela to Uruguay and northern Argentina (Fig. 3). In Ecuador it has been described from both the eastern and western slopes of the Andes at altitudes up to 2,500 m (Lönnberg, 1921, 1921–1922; Thomas, 1901, 1914). The species is absent from the llano grasslands of Venezuela (Eisenberg, 1989). Distribution in Argentina is restricted primarily to the eastern portions of the provinces of Salta and Jujuy, northeastern Santa Fe, eastern portions of Chaco and Formosa, and throughout Misiones and Corrientes (Mares et al., 1989; Olrog, 1979; Olrog and Lucero, 1981; Redford and Eisenberg, 1992). *N. nasua* has also been introduced to Robinson Crusoe, one of the Juan Fernández Islands of Chile (Colwell, 1989; Miller and Rottmann, 1976; Pine et al., 1979).

FOSSIL RECORD. While procyonids first entered South America by island-hopping in the late Miocene, these species were not ancestral to modern coatis (Simpson, 1950). *Nasua* evolved in North America and was a participant in the Great American Interchange following the rise of the Panamanian land bridge in the Pliocene (Baskin, 1982, 1986; Simpson, 1950; Webb, 1985). *Nasua* and *Procyon* likely differentiated from the genus *Paranasua* during the Hemphillian (late Miocene), as first probable records of each genus are from the late Hemphillian of Florida and Kansas (Baskin, 1982). In North America the fossil *Nasua* are represented by a possible species of *Nasua* (Baskin, 1982) from the late Miocene of Florida, and by *N. pronarica* (Dalquest, 1978) from the middle Blancan (early Pliocene) of Texas. Earliest records of South American *Nasua* are possibly Ensenadan (late Pleistocene) fossils from Tarija, Bolivia (Hoffstetter, 1963; Marshall et al., 1984), and

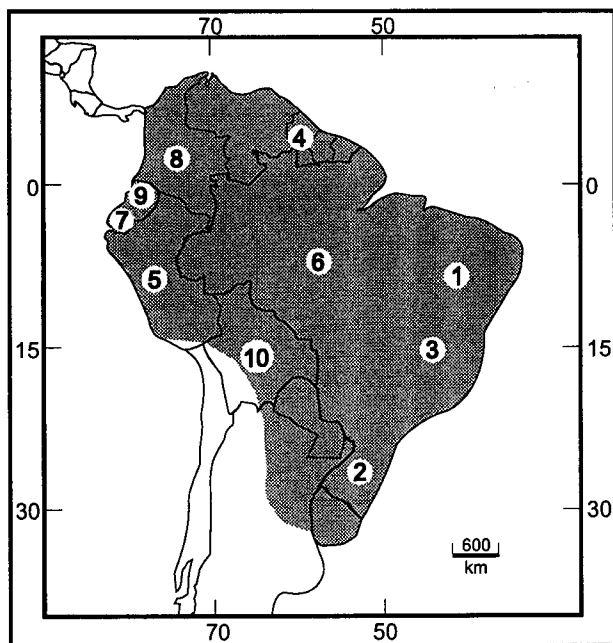


FIG. 3. Distribution of *Nasua nasua* in South America. Determination of extreme localities (Columbia and Argentina) was based on individual specimens examined by Decker (1991). Numbers refer to type localities of subspecies: 1, *N. n. nasua*; 2, *N. n. spadicea*; 3, *N. n. solitaria*; 4, *N. n. vittata*; 5, *N. n. montana*; 6, *N. n. dorsalis*; 7, *N. n. quichua*; 8, *N. n. candace*; 9, *N. n. manium*; 10, *N. n. boliviensis*.

Lujanian (latest Pleistocene) fossils from caves in Minas Gerais, Brazil (Berta and Marshall, 1978; Winge, 1895–1896).

FORM AND FUNCTION. The dental formula is $i\ 3/3, c\ 1/1, p\ 4/4, m\ 2/2$, total 40, and teeth are generally smaller than *Procyon lotor* and larger than *Nasuella olivacea* (Hollister, 1916). The canines are large, especially the adult male lower canine, and laterally compressed with the points turned outward. Premolars are two or three-rooted (Hollister, 1916; Husson, 1978; Vieira, 1946). Length of the jaw and length of the tooth row are long relative to other procyonids, resembling measurements found in canids (Radinsky, 1981). As with all procyonids, ursids, and mustelids, *N. nasua* does not possess a cecum. However, unlike mustelids, ursids, and *Potos flavus*, the caliber of the intestinal tract of *N. nasua* increases distal to the terminal or recurrent straight portion of the Meckel's tract, and the anterior mesenteric vein bends sharply to receive numerous vessels from the minor loop of Meckel's tract (Mitchell, 1905).

The ear is short and rounded, with a shallow pouch-shaped bursa in front of the posterior edge of the pinna (Pocock, 1921). Procyonids possess enlarged auditory bullae, which are achieved by gradual caudal entotympanic growth, relative to other carnivores (Hunt, 1974). The auditory bulla of *N. nasua* is similar in height and inflation to that of *Procyon lotor*, although smaller, and showing differences in caudal entotympanic form. The alisphenoid canal is absent (Flower, 1869; Hough, 1948; Pocock, 1928). Auditory function of *N. nasua* represents an efficient mode of sound reception relative to other Carnivora, because of a delayed decline of sensitivity, a relatively high sensitivity, and a wide band of peak sensitivity. The region of maximum sensitivity extends 7.4 octaves, with an upper frequency limit of 95 kHz, and a range of maximal peripheral sensitivity of 250 Hz to 45 kHz (Peterson et al., 1969).

The brain of *N. nasua* is morphologically similar to that of *N. narica* (Anthony and Botar, 1933), but differs from those of other procyonids in having an enlarged sensory cortex region receiving afferent projections from the tip of the snout or rhinarium and a forepaw reception area specialized for movement of joints. These data are compatible with observations that species of *Nasua* have the longest snout and claws of the Procyonidae (Barker and Welker, 1969; Pubols et al., 1965; Welker and Campos, 1963). Two adult

female *Nasua*, unidentified to species, had brain weights of 34.9 and 39.0 g (Welker and Campos, 1963).

The snout of *N. nasua* is greatly elongated, with the upper edge of the rhinarium extending beyond the nostrils, such that the anterior surface is nearly flat and slopes obliquely down and back. The upper lip is entire, showing no trace of a philtrum. Nostrils are elongated rather than being semicircular as in other procyonids. The internarial septum is long and narrow, with deep intranarial portions defined by a groove from the adjoining central portion, which has no median groove. The rostral surface of the rhinarium is densely innervated by sensory receptors, and rhinarial contact with stimuli is made more intimate and varied by the action of numerous proboscis muscles, allowing unusually high mobility of the proboscis (Compton, 1966; Pocock, 1921; Windle and Parsons, 1897). The facial vibrissae are better developed in *Nasua* than in other procyonids (Pocock, 1921).

The eye of *N. nasua* contains a reflective tapetum, which indicates that diurnal activity may have evolved from a nocturnal ancestor. In addition, *N. nasua* has color vision. Unlike *Potos flavus*, *N. nasua* shows discriminative abilities between color hues, which may be an adaptation for foraging on brightly colored fruits (Chausseil, 1992). Eyes of *N. nasua* are dichromatic, with one of the two cone photopigments having a peak sensitivity at 430 nm, further evidence of color vision (Jacobs, 1993; Jacobs and Deegan, 1992).

Nasua nasua has shorter limbs than does *Procyon lotor*. The radius in an adult male weighing 4.6 kg was 77.0 mm long, while that of a *P. lotor* of similar mass measured 93.5 mm. Mean fascicle lengths for various muscles in a muscle group vary little intraspecifically (McClern, 1985, 1990). Limb myology of *N. nasua* is described by Windle and Parsons (1897, 1898). The fibula is slender, fused to the tibia at the upper end, and articulates by a synovial joint at the lower end, where rotary movement is permitted by the flexibility of the fibula (Barnett and Napier, 1953). The forefeet contain long, powerful, blunt, and slightly curved claws, with digits webbed to the proximal ends of the digital pads. The underside of the digits and webs are naked, and the plantar pad is broad, moderately well defined, and four-lobed. Above the carpal pad on the ulnar side is a tuft of carpal vibrissae. Claws of the hind feet claws are somewhat shorter than those on the forefeet, and the plantar pad is naked over the whole of the tarsometatarsal area as far back as the tip of the calcaneum (Pocock, 1921). *N. nasua* is unable to fully reverse its hind foot as does the fully arboreal *Potos flavus*. Head-first descent is accompanied by femoral abduction and an approximate 60° inversion and 60° rotation at the transverse tarsal joint. *N. nasua* is thus able to grasp a verticle trunk or vine, but cannot turn the toes posteriorly nor reverse the plantar surface of the foot (Jenkins and McClern, 1982, 1984). At walking speeds *N. nasua* employs a lateral sequence, lateral couplets gait, switching to a slow canter at speeds of approximately 1 m/sec. *N. nasua* will gallop for short distances, but has not been observed to trot (McClern, 1992).

The baculum is spatulate dorsally with a prominent central lobe on the ventral surface and an indistinctly bifid distal end (Burt, 1960; Chaine, 1925; Decker, 1991; Didier, 1950; Mondolfi, 1987; Pocock, 1921). Layne (1954) reports an os clitoris in *Nasua*. The lamina propria of the seminiferous tubules is 1–3 μ m thick and contains a single layer of myofibroblasts (Christl, 1990). Anal glands of *N. nasua* are highly modified, with a glandular area situated along the dorsal margin of the anus containing a series of pouches that open by four or five slits on each side. These glands are unique among Carnivora (Pocock, 1921). Preputial glands of *N. nasua* are multilobed structures made of branched alveoli which empty through a series of ducts to the squamous epithelium of the prepuce. Sebaceous material secreted from these glands is used in scent-marking, perhaps in combination with urine (Fiedler, 1955, 1957; Shannon et al., 1995).

Like most carnivores, *N. nasua* has a single major hemoglobin, and analyses of *N. nasua* hemolysate revealed an α - and a β -globin chain (Ahmed et al., 1990; Brimhall et al., 1977, 1979; Seal, 1969; Stenzel and Brimhall, 1977). Three unidentified coats had a venous pH of 7.35, with blood gas and hematological values similar to the kinkajou and raccoon (Satterfield, 1976; Soifer, 1970). Mean body temperature for two 2-year-old captive males was $38.3 \pm 0.5^\circ\text{C}$ during the day and $36.4 \pm 0.3^\circ\text{C}$ at night (Chevallard-Hugot et al., 1980). Measured physiological characteristics of these coats revealed a basal metabolic rate of ca. 60% the predicted

value, excellent thermoregulatory ability in the cold—partly due to decreasing thermal conductance at falling ambient temperatures, and thermal stability up to 35°C. Basal heart rate was 70 beats/min, about 70% of the predicted value. Chevillard-Hugot et al. (1980) suggest cold might not be a limiting factor for adults, but may be for juveniles.

Pulmonary arteries of *Nasua nasua* are relatively thin, and collateral ventilation is absent (Wagner et al., 1991). Unlike *N. narica*, which has very muscular pulmonary arteries and a vigorous pulmonary pressor response to acute hypoxia (Hanson et al., 1993), in *N. nasua* localized alveolar hypoxia leads to vasoconstriction, and blood flow is diverted away from affected lung regions (Grant et al., 1976; Hughes, 1975; Robinson, 1982). The morphology of the heart of *N. nasua* is described by Heine (1973).

ONTOGENY AND REPRODUCTION. Gestation period of *N. nasua* is 74–77 days (Brown, 1936; Leclerc-Cassan, 1976; Standley, 1992). The placenta is zonary with a slight break towards the mesometrial side of the gravid uterus and with a large extravasation appended on the antimesometrial side. Maternal blood is present in a hematome covered by an allantochorionic membrane (Vacek, 1951, 1970). Milk from one captive individual contained 25% dry matter and 9% raw protein (Bock et al., 1984).

Captive litter size varies from 1 to 7 (Ben Shaul, 1962; Findlay et al., 1971; McToldridge, 1969) with 3–4 being most common (Standley, 1992). Allonursing has been observed in captivity (McToldridge, 1969). In one captive litter from which not all neonates survived and in which those that did were hand-reared after five days, neonates weighed 78 g at 5 days. Eyes opened at 10 days, and newborns were standing firmly by 19 days. At 24 days the newborns were walking well and were able to focus their eyes. At 26 days the infants started to climb (Ben Shaul, 1962).

In the wild, females leave the group and give birth to young in a nest constructed in a tree (Emmons, 1990). After 5 or 6 weeks the female rejoins the group with her newborns (Cabrera and Yepes, 1960). In Parque Nacional Iguazu, Misiones, Argentina, breeding occurs between October and February, and litters are usually born in March and April, although newborns have been observed in late November (Crespo, 1982).

ECOLOGY. *Nasua nasua* is primarily an occupant of forested habitat. It has been reported from multistratal deciduous and evergreen rainforest, riverine gallery forest, cloud forest, and xeric chaco, cerrado, and dry scrub forests (Brooks, 1993; Emmons, 1990; Handley, 1976; Mondolfi, 1976; Schaller, 1983). It is found over a wide altitudinal range, with Andean individuals found at elevations up to 2,500 m (Lönnberg, 1921; Thomas, 1901, 1914). In El Bagual Ecological Reserve, Argentina, track counts over four habitat types indicate heavy use of low and early-seral forests and no use of high forests or savanna habitats (Yanosky and Mercolli, 1992).

Nasua nasua is omnivorous, eating predominantly invertebrates and fruit, although vertebrates and carrion are also consumed when available. Stomach contents of three *N. nasua* from Venezuela contained adult and larval beetles, scorpions, spiders, centipedes, and fruits of *Guazuma ulmifolia*. One unidentified reptile was found in the stomach of an adult female. Adult and larval coleopterans comprised 20% of total stomach volume and occurred in all three animals examined (Bisbal, 1986). Stomach contents of 12 *N. nasua* from Bolivia contained 69.5% fruit by volume (11 of 12 stomachs) and 30.5% invertebrates (9 of 12 stomachs). Principal foods were fruits of *Pseudolmedia laevis*, *Jacaratia digitata*, *Scheelea princeps*, *Cecropia*, and coleopterans. One stomach contained a small cricetid rodent (Redford and Stearman, 1993). In the Pantanal of Brazil, *N. nasua* was observed feeding on fruits of *Ficus* and *Copernicia* palms, and two stomachs contained fish, snakes, crabs, and other invertebrates (Schaller, 1983). *N. nasua* is an important predator on the eggs of the Paraguayan caiman, *Caiman yacare* (Crawshaw and Schaller, 1980). *N. nasua* eats tarantulas after rolling the spider to remove urticating setae. Nevertheless, brown-nosed coatis learn to avoid some species, such as *Theraphosa blondi*, whose setae are difficult to remove (West, 1993). Myers (1930) observed that a habituated brown-nosed coati ate a wide variety of invertebrates but also rejected many species such as ants, termites, and insects which emit noxious fluids or odors. The diet of captive *N. nasua* is discussed by Standley (1992).

Reported predators of *N. nasua* include the jaguar (*Panthera onca*), puma (*Felis concolor*), ocelot (*F. pardalis*) and jaguarundi (*F. yagouaroundi*)—Almeida, 1990; Crespo, 1982; Emmons, 1987; Jorgenson and Redford, 1993; Redford and Eisenberg, 1992; Sanderson, 1949; Schaller, 1983). Hoogesteijn et al. (1993) report two or three *N. nasua* found in the stomach of a *P. onca* from Brazil.

Population density of *N. nasua* varies greatly from region to region. In the Pantanal of the Acurizal ranch in Mato Grosso, Brazil, *N. nasua* has the greatest biomass of the six species of small carnivores in the region. Estimates of densities are 1.5 bands or 6.2 individuals/km² in a region of low-lying deciduous forest. In taller gallery forest densities are 13 individuals/km². These densities may represent a dry season concentration near water (Schaller, 1983). Similarly, at the Fazenda Nhumirim research station in Mato Grosso do Sul, *N. nasua* is the most frequently observed species during diurnal censuses, accounting for 62% of mammal observations and 19% of mammal biomass (Alho et al., 1987; Lacher et al., 1986). *N. nasua* is also the most abundant carnivore in Parque Nacional Iguazu, Argentina (Crespo, 1982). The sex ratio of *N. nasua* killed by hunters in Bolivia was 1:1.15 (male:female; $n = 56$ —Redford and Stearman, 1993).

Nasua nasua is hunted by colonists and indigenous peoples and is often an important food source (Alvard, 1995; Berlin and Berlin, 1983; Hill and Hawkes, 1983; Jorgenson and Redford, 1993; Redford and Robinson, 1987, 1991; Yost and Kelley, 1983). For some indigenous peoples *N. nasua* is not a preferred food because of cultural taboos or taste preferences (Stearman, 1990; Stearman and Redford, 1995). Yuquí hunters of Bolivia killed 60 *N. nasua* during 40 hunts, with multiple captures in 30% of hunts. Of 11 cases where hunters encountered a band, three resulted in one animal killed, three in three animals killed, and one in four animals killed (Redford and Stearman, 1993). In Bolivia and Paraguay an estimated 65–73% of animals killed are adults (Redford and Stearman, 1993). The Aché of Paraguay hunt *N. nasua* by hand; animals are grabbed as they attempt to escape by jumping from trees and killed when the hunter slams the animal against the ground. Hunting success per Aché hunter decreased with increased hunting group size (Hill and Hawkes, 1983).

In Venezuela *N. nasua* is common in secondary forest and along forest edges, and Bisbal (1993) suggests that habitat modification due to low-level deforestation and road building and to petroleum, timber, and mineral extraction might have only slightly negative, and perhaps positive, effects on populations. In contrast, intensive deforestation, dam-building and hunting affects populations negatively (Bisbal, 1993; Mondolfi, 1976).

Nasua nasua was introduced by humans to the Juan Fernández Islands, Chile, in 1935 when two pregnant females escaped (Guzmán Parada, 1951; Miller and Rottmann, 1976; Pine et al., 1979; Valenzuela Fuenzalida, 1978). The population rapidly expanded and in 1972 was estimated to be 4,000 individuals. It has been implicated in the decline of the endemic Juan Fernández firecrown hummingbird, *Sephanoides fernandensis*, and the pink-footed shearwater, *Puffinus creatopus* (Colwell, 1989; Miller and Rottmann, 1976). Digging habits of *N. nasua* have also been implicated as a possible important factor in the deterioration of the native flora (Sanders et al., 1982).

Known endoparasites of *N. nasua* include *Trypanosoma cruzi*, *T. evansi*, and *T. rangeli* (Ferriolli and Barretto, 1968; Miles et al., 1983; Nunes and Oshiro, 1990; Nunes et al., 1993; Oshiro et al., 1990), *Leishmania shawi* (Lainson et al., 1989), the tapeworms *Atriateneia parva* and *Diphyllobothrium trinitatis* (Schmidt and Martin, 1978), kidney worm *Diectophyma renale* (Canese, 1973), acanthocephalans *Oncicola* (= *Prosthenorchis*) *luehei* and *O. spirula* (Machado Filho, 1950; Schmidt, 1977), nematodes *Dirofilaria acutiusscula* and *Cylicospirura subaequalis* (Seesee et al., 1980), and *Schistosoma mansoni* (Artigas and Perez, 1967; Perez and Artigas, 1970; Ruiz, 1953). Serologic tests showed that brown-nosed coatis in Brazil had neutralization antibodies for a *Bunyavirus* arbovirus (Travassos de Rosa et al., 1992). Under artificial conditions *N. nasua* is susceptible to infection with the schistosome *Heterobilharzia americana* (Malek, 1970), pseudorabies (Eskens et al., 1981), and the fungus *Microsporium gypseum* (Findlay et al., 1971). *N. nasua* is potentially susceptible to, or a carrier of, a variety of infectious diseases pathogenic to man and other animals (reviewed by Wallach and Boever, 1983), including tuberculosis (*Mycobacterium* (Dolan, 1993; Nóbrega and Reis, 1941; Spencer and Barnes, 1973), canine distemper (Appel and Gillespie, 1972;

Mickwitz, 1968), feline panleucopaenia (Johnson and Halliwell, 1968), *Leptospira* (Lins and Lopes, 1984), and the fungi histoplasmosis and sporotrichosis (Costa et al., 1994). Reported ticks of *N. nasua* include *Ambylomma ovale* and *Ixodes loricatus* (Barros and Baggio, 1992). Carcinoma of the nasal sinus (Lombard and Witte, 1959), liver damage due to septicemia toxemia (Shannon et al., 1995), and aneurism of the aorta (Ferney, 1966) are reported in captive brown-nosed coatis. Grabeman and Davis (1982) describe treatment of malocclusion and oronasal fistula of the mouth of an adult *N. nasua*.

BEHAVIOR. *Nasua nasua* is diurnal and spends the night sleeping in trees (Alho et al., 1987; Brooks, 1993; Crespo, 1982; Lacher et al., 1986; Standley, 1992; Yanosky, 1991). While it is primarily terrestrial, it easily descends or ascends small trees and vines. It has more difficulty climbing the smooth trunks of large trees, and normally descends or ascends by moving out to the end of a limb and transferring to nearby branches of the same tree (McClean, 1992). When disturbed in trees, *N. nasua* immediately returns to the ground and escapes terrestrially (Crespo, 1982; Husson, 1978). Brown-nosed coatis are good swimmers (Liais, 1872; Standley, 1992).

Adult males are solitary, while females and immature males travel in groups of up to 30 individuals (Crespo, 1982; Emmons, 1990; Schaller, 1983). Detailed studies of band size have not been conducted. However, in Mato Grosso, Brazil, bands contain up to 13 members with an average band size of 5.3, of which 44% are subadults (Schaller, 1983). Crespo (1982) reports bands of up to 20 individuals in Parque Nacional Iguazu, Argentina. Group members give constant contact vocalizations (Emmons, 1990).

Successive discrimination performances on spatial tasks by *N. nasua* do not differ from those of *Potos flavus* or *Procyon lotor*, but are poorer than those of *Bassariscus astutus* (Gossette et al., 1968). In tests of visual learning and concept formation in captive individuals, *N. nasua* is able to respond correctly to cognitive tests of same-difference and shape recognition (Chausseil, 1991).

GENETICS. Diploid chromosome number of *N. nasua* is 38, including 28–30 metacentric and submetacentric autosomes, 6–8 acrocentric autosomes, a submetacentric X, and a submetacentric Y (Hsu and Benirschke, 1970; Panzetta and Alaimo, 1967, 1969; Wurster and Benirschke, 1968). Examination of cytogenetic G-banding in a zoo colony of *N. nasua*, *N. narica*, and hybrid individuals revealed that hybridization results in complex chromosome rearrangements (Verleye et al., 1987).

Coat color is influenced by sex and by parental genotype. A cross of a red male with a brown female resulted in an F1 of red males and brown females. Crossings of the presumably heterozygous F1 produced F2 offspring which included red males and females as well as brown females (Taibel, 1958).

CONSERVATION STATUS. *Nasua nasua* is legally protected under CITES Appendix III in Uruguay (Emmons, 1990).

REMARKS. Confusion over the status of solitary males led early researchers to designate separate species names, *N. solitarius* Schinz, 1821 and *N. sociabilis* Schinz, 1821, for adult males and for gregarious band members, respectively, and many of the common names still used in North and South America perpetuate the confusion. Although the name coati monde from the Brazilian vernacular properly refers to solitary males, it is often used to denote all coatis. Through usage the spelling has become coatimundi (Hensel, 1869; Kaufmann, 1962, 1983). *N. nasua* is also referred to as the ring-tailed, southern, or South American coati (Decker, 1991; Emmons, 1990; Mares et al., 1989). Common names for *N. nasua* include coatí (Guarani), kúshi (Huambisa and Aguaruna), kane (Aché), achuni (Peru), tejón (Ecuador), cuzumbo (Columbia), quati, quatimundé (Brazil), kafi (Kalapalo), cochínigo (Argentina), neusbeer, kwaskwasi (Surinam-Basso, 1973; Berlin and Berlin, 1983; Emmons, 1990; Hill and Hawkes, 1983; Lönnberg, 1921; Patton et al., 1981). The common name coati is of Tupian Indian origin, cua meaning belt, and tim meaning nose, referring to the coatis' sleeping position of the nose tucked on the belly (Liais, 1872; Kaufmann, 1962). The scientific name *Nasua* is derived from the Latin *nasus*, meaning nose (Gotch, 1979).

LITERATURE CITED

AHMED, A., M. JAHAN, AND G. BRAUNITZER. 1990. Carnivora: the primary structure of hemoglobin from adult coati (*Nasua na-*

sua rufa, Procyonidae). Journal of Protein Chemistry, 9:23–29.

- ALHO, C. J. R., T. E. LACHER, JR., Z. M. S. CAMPOS, AND H. C. GONÇALVES. 1987. Mamíferos da Fazenda Nhumirim, sub-região de Nhecolândia, Pantanal do Mato Grosso do Sul. I. Levantamento preliminar de espécies. Revista Brasileira de Zoologia, 4:151–164.
- ALLEN, J. A. 1879. On the coatis (genus *Nasua*, Storr). Bulletin of the United States Geological and Geographical Survey of the Territories, 5:153–174.
- . 1904. New mammals from Venezuela and Colombia. Bulletin of the American Museum of Natural History, 20:327–335.
- . 1916a. List of mammals collected for the American Museum in Ecuador by William B. Richardson, 1912–1913. Bulletin of the American Museum of Natural History, 35:113–125.
- . 1916b. List of mammals collected in Columbia by the American Museum of Natural History Expeditions, 1910–1915. Bulletin of the American Museum of Natural History, 35:191–238.
- . 1916c. Mammals collected on the Roosevelt Brazilian Expedition, with field notes by Leo E. Miller. Bulletin of the American Museum of Natural History, 35:559–610.
- ALMEIDA, T. DE. 1990. Jaguar hunting in the Mato Grosso and Bolivia. Safari Press, Long Beach, California, 275 pp.
- ALVARD, M. 1995. Shotguns and sustainable hunting in the Neotropics. Oryx, 29:58–66.
- ANTHONY, R. L. F., AND J. BOTAR. 1933. Le néopallium des procyonidés. Publications du Muséum National d'Histoire Naturelle, 3:81–93.
- APPEL, M. J. G., AND J. H. GILLESPIE. 1972. Canine distemper virus. Virology Monographs, 11:1–96.
- ARTIGAS, P. T., AND M. D. PEREZ. 1967. Observações em animais silvestres experimentalmente infestados com *Schistosoma mansoni* Sambon, 1907. Revista. Faculdade de Farmácia e Bioquímica, Universidade de São Paulo, 5:133–139.
- AVILA-PIRES, F. D. DE. 1965. The type specimens of Brazilian mammals collected by Prince Maximilian zu Wied. American Museum Novitates, 2209:1–21.
- BARKER, D. J., AND W. I. WELKER. 1969. Receptive fields of first-order somatic sensory neurons innervating rhinarium in coati and raccoon. Brain Research, 14:367–386.
- BARNETT, C. H., AND J. R. NAPIER. 1953. The rotary mobility of the fibula in eutherian mammals. Journal of Anatomy, 87:11–21.
- BARROS, D. M., AND D. BAGGIO. 1992. Ectoparasites Ixodida Leach, 1917 on wild mammals in the state of Paraná, Brazil. Memórias do Instituto Oswaldo Cruz, 87:281–296.
- BASKIN, J. A. 1982. Tertiary Procyoninae (Mammalia: Carnivora) of North America. Journal of Vertebrate Paleontology, 2:71–93.
- . 1986. The late Miocene radiation of Neotropical sigmodontine rodents in North America. Contributions to Geology, University of Wyoming, Special Paper 3:287–303.
- BASSO, E. B. 1973. The Kalapalo Indians of Central Brazil. Holt, Rinehart and Winston, New York, 157 pp.
- BEN SHAUL, D. M. 1962. Notes on hand-rearing various species of mammals. International Zoo Yearbook, 2:300–332.
- BERLIN, B., AND E. A. BERLIN. 1983. Adaptation and ethnozoological classification: theoretical implications of animal resources and diet of the Aguaruna and Huambisa. Pp. 301–325, in Adaptive responses of native Amazonians (R. B. Hames and W. T. Vickers, eds.). Academic Press, New York, 516 pp.
- BERTA, A., AND L. G. MARSHALL. 1978. Fossilium Catalogus I: Animalia. South American Carnivora. W. Junk, The Hague, 125:1–48.
- BISBAL, F. J. 1986. Food habits of some neotropical carnivores in Venezuela (Mammalia, Carnivora). Mammalia, 50:329–339.
- . 1993. Impacto humano sobre los carnívoros de Venezuela. Studies on Neotropical Fauna and Environment, 28:145–156.
- BLAINVILLE, H. M. D. DE. 1839–1864. Ostéographie, ou description iconographique des mammifères. Paris (in 26 separately paginated parts).
- BOCK, H.-D., J. WUNSCH, F. KREIENBRING, K. LINKE, AND G.

- FRICKE. 1984. Über die Aminosäurezusammensetzung der Milchproteine einiger Zootierspezies. *Zoologischer Garten N. F.*, Jena, 54:359–353.
- BRIMHALL, B., K. STANGLAND, R. T. JONES, R. R. BECKER, AND T. J. BAILEY. 1979. Tryptic peptide compositions of hemoglobins from mink (*Mustela vison*) and hyena (*Hyaenae hyaenae*) and the α -chain of coatimundi (*Nasua nasua*). *Hemoglobin*, 3:271–292.
- BRIMHALL, B., ET AL. 1977. On the tryptic peptides from hemoglobin chains of six carnivores. *Journal of Molecular Evolution*, 9:237–260.
- BROOKS, D. M. 1993. Observations on procyonids in Paraguay and adjacent regions. *Small Carnivore Conservation*, 8:3–4.
- BROWN, C. E. 1936. Rearing wild animals in captivity, and gestation periods. *Journal of Mammalogy*, 17:10–13.
- BURT, W. H. 1960. *Bacula of North American mammals*. Miscellaneous Publications of the Museum of Zoology, University of Michigan, 113:1–75.
- CABRERA, A. 1956. Una nueva forma del genero *Nasua*. *Neotropica*, 2(7):1–4.
- . 1958. Catalogo de los mamíferos de America del Sur. *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"*, 4:1–307.
- CABRERA, A., AND J. YEPES. 1960. Mamíferos Sud Americanos. Second ed. Ediar, Buenos Aires, 2:1–187.
- CANESE, A. 1973. *Diocoryphus renale* (Goeze, 1782) Stiles 1901 en coati (*Nasua solitaria*). *Revista Paraguaya de Microbiología*, 8:56.
- CHAIEN, J. 1925. L'os pénien, étude descriptive et comparative. *Actes de la Société Linéenne de Bordeaux*, 78:5–195.
- CHAUSSAIL, M. 1991. Visual same-different learning, and transfer of the sameness concept by coatis (*Nasua* Storr, 1780). *Ethology*, 87:28–36.
- . 1992. Evidence for color vision in procyonids: comparison between diurnal coatis (*Nasua*) and nocturnal kinkajous (*Potos flavus*). *Animal Learning and Behavior*, 20:259–265.
- CHEVILLARD-HUGOT, M.-C., E. F. MÜLLER, AND E. KULZER. 1980. Oxygen consumption, body temperature and heart rate in the coati (*Nasua nasua*). *Comparative Biochemistry and Physiology*, 65A:305–309.
- CHRISTL, H.-W. 1990. The lamina propria of vertebrate seminiferous tubules: a comparative light and electron microscopic investigation. *Andrologia*, 22:85–94.
- COLWELL, R. K. 1989. Hummingbirds of the Juan Fernández Islands: natural history, evolution and population status. *Ibis*, 131:548–566.
- COMPTON, R. W. 1966. The skeletal musculature innervated by the facial nerve in the coati (*Nasua*). *American Zoologist*, 6:540.
- CORBET, G. B., AND J. E. HILL. 1986. A world list of mammalian species. Second ed. British Museum of Natural History, London, 226 pp.
- COSTA, E. O., L. S. M. DINIZ, C. FAVA NETTO, C. ARRUDA, AND M. L. Z. DAGLI. 1994. Epidemiological study of sporotrichosis and histoplasmosis in captive Latin American wild mammals, São Paulo, Brazil. *Mycopathologia*, 125:19–22.
- CRAWSHAW, P. G., JR., AND G. B. SCHALLER. 1980. Nesting of Paraguayan caiman (*Caiman yacare*) in Brazil. *Papéis Avulsos de Zoologia*, São Paulo, 33:283–292.
- CRESPO, J. A. 1982. Ecología de la comunidad de mamíferos del Parque Nacional Iguazu, Misiones. *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"*, 3:1–162.
- DALQUEST, W. W. 1978. Early Blanford mammals of the Beck Ranch local fauna of Texas. *Journal of Mammalogy*, 59:269–298.
- DECKER, D. M. 1991. Systematics of the coatis, Genus *Nasua* (Mammalia: Procyonidae). *Proceedings of the Biological Society of Washington*, 104:370–386.
- DESMAREST, A. G. 1804. Tableaux methodiques des mammiferes. Pp. 5–38, in *Tableaux methodique d'histoires naturelles*. Dictionnaire d'Histoire Naturelle. Paris, 24:1–238.
- DIDIER, R. 1950. Etude systematique de l'os penien des mammiferes. *Mammalia*, 14:78–94.
- DOLAN, J. M., JR. 1993. The mammal collection of the Zoological Society of San Diego, a historical perspective. Part VIII: Canidae to Ailuropodidae. *Der Zoologische Garten*, 63:335–380.
- EISENBERG, J. F. 1989. *Mammals of the Neotropics. The northern Neotropics*. University of Chicago Press, Chicago, 1:1–449.
- EMMONS, L. H. 1987. Comparative feeding ecology of felids in a neotropical rainforest. *Behavioral Ecology and Sociobiology*, 20:271–283.
- . 1990. *Neotropical rainforest mammals: a field guide*. University of Chicago Press, Chicago, 281 pp.
- ESKENS, V. U., K. FRESE, AND E. KNECHT-WICKE. 1981. Aujeszky'sche Krankheit bei südamerikanischen Nasenbären (*Nasua nasua*). *Berliner und Münchener Tierärztliche Wochenschrift*, 94:105–108.
- FERNEY, J. 1966. Anévrisme de l'aorte sur un coati (*Nasua rufa* Desm.). *Der Zoologische Garten*, 33:123–125.
- FERRIOLLI, F., AND M. P. BARRETTO. 1968. Estudos sobre reservatórios e vectores silvestres do *Trypanosoma cruzi*. XXIX. Infecção natural da *Nasua nasua solitaria* Schinz, 1821 pelo *T. cruzi*. *Revista. Instituto de Medicina Tropical de São Paulo*, 10:354–363.
- FIEDLER, W. 1955. Über einige Fälle von Markierungsverhalten bei Säugetieren. *Revue Suisse de Zoologie*, 62:230–240.
- . 1957. Beobachtungen zum Markierungsverhalten einiger Säugetieren. *Zeitschrift für Säugetierkunde*, 22:57–76.
- FINDLAY, G. H., H. F. ROUX, AND I. W. SIMSON. 1971. Uncontrolled *Microsporum gypseum* infection in a newborn mammal. *British Journal of Dermatology*, 85, supplement 7:87–93.
- FLOWER, W. H. 1869. On the value of the characters of the base of the cranium in the classification of the order Carnivora, and on the systematic position of *bassarids* and other disputed forms. *Proceedings of the Zoological Society of London*, 1869:4–37.
- GEOFFROY SAINT-HILAIRE, E. 1803. *Catalogue des mammiferes du Museum National d'Histoire Naturelle*. Paris, 272 pp.
- GMELIN, J. F. 1788. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis synonymis locis*. Georges Emanuelle Beer, Lipsiae, 1:1–232.
- GOSSETTE, R. L., G. KRAUS, AND J. SPEISS. 1968. Comparison of successive discrimination reversal (SDR) performances of seven mammalian species on a spatial task. *Psychonomic Science*, 12:193–194.
- GOTCH, A. F. 1979. *Mammals, their Latin names explained*. Blanford Press, Poole, 271 pp.
- GRABEMAN, T. A., AND W. J. DAVIS. 1982. Malocclusion and oronasal fistula in a coatimundi: treatment by an endodontic procedure. *Journal of the American Veterinary Medical Association*, 181:1403–1405.
- GRANT, B. J. B., E. E. DAVIES, H. A. JONES, AND J. M. B. HUGHES. 1976. Local regulation of pulmonary blood flow and ventilation-perfusion ratios in the coatimundi. *Journal of Applied Physiology*, 40:216–228.
- GRAY, J. E. 1866. Notice of a new species of *Nasua*. *Proceedings of the Zoological Society of London*, 1866:169–170.
- GUZMAN PARDA, J. 1951. *Cumbres oceánicas: las Islas de Juan Fernández*. Bustos y Letelier, Santiago, 246 pp.
- HANDLEY, C. O., JR. 1976. *Mammals of the Smithsonian Venezuelan project*. Brigham Young University Science Bulletin, Biological Series, 20:1–89.
- HANSON, W. L., D. F. BOGGS, J. M. KAY, S. E. HOFMEISTER, AND W. W. WAGNER, JR. 1993. Collateral ventilation and pulmonary arterial smooth muscle in the coati. *Journal of Applied Physiology*, 74:2219–2224.
- HEINE, H. 1973. Das Herz der Procyonidae, Ailuridae und Ursidae (Carnivora, Fissipedia). Ein Beitrag zur vergleichenden funktionellen Morphologie des Säugetierherzens. *Zeitschrift für wissenschaftliche Zoologie*, 186:1–52.
- HENSEL, R. 1869. Beiträge zur Kenntniss der Thierwelt Brasiliens. *Zoologischer Garten*, 10:289–296.
- HERSHKOVITZ, P. 1959. Nomenclature and taxonomy of the neotropical mammals described by Olfers, 1818. *Journal of Mammalogy*, 40:337–353.
- HILL, K., AND K. HAWKES. 1983. Neotropical hunting among the Aché of Eastern Paraguay. Pp. 139–188, in *Adaptive responses of native Amazonians* (R. B. Hames and W. T. Vickers, eds.). Academic Press, New York, 516 pp.
- HOFFSTETTER, R. 1963. La faune pléistocène de Tarija (Bolivie). *Bulletin du Muséum National d'Histoire Naturelle, Serie 2*, 35:194–203.

- HOLLISTER, N. 1916. The genera and subgenera of raccoons and their allies. *Proceedings of the United States National Museum*, 49:143-152.
- HONACKI, J. H., K. E. KINMAN, AND J. W. KOEPL. 1982. *Mammal species of the world: a taxonomic and geographic reference*. Allen Press, Inc. and The Association of Systematic Collections, Lawrence, Kansas, 694 pp.
- HOOGESTEIJN, R., A. HOOGESTEIJN, AND E. MONDOLFI. 1993. Jaguar predation and conservation: cattle mortality caused by felines on three ranches in the Venezuelan Llanos. *Symposium of the Zoological Society of London*, 65:391-407.
- HOUGH, J. R. 1948. The auditory region in some members of the Procyonidae, Canidae, and Ursidae. *Bulletin of the American Museum of Natural History*, 92:67-118.
- HSU, T. C., AND K. BENIRSCHKE. 1970. *An atlas of mammalian chromosomes*. Springer Verlag, New York, Volume 4, Folio 183, unpagued.
- HUGHES, J. M. B. 1975. Lung gas tensions and active regulation of ventilation/perfusion ratios in health and disease. *British Journal of Diseases of the Chest*, 69:153-170.
- HUNT, R. M., JR. 1974. The auditory bulla in Carnivora: an anatomical basis for reappraisal of carnivore evolution. *Journal of Morphology*, 143:21-76.
- HUSSON, A. M. 1978. *The mammals of Suriname*. E. J. Brill, Leiden, 569 pp.
- JACOBS, G. H. 1993. The distribution and nature of colour vision among the mammals. *Biological Reviews*, 68:413-471.
- JACOBS, G. H., AND J. F. DEEGAN II. 1992. Cone photopigments in nocturnal and diurnal procyonids. *Journal of Comparative Physiology A*, 171:351-358.
- JENKINS, F. A., JR., AND D. MCCLEARN. 1982. Tarsal mechanisms of foot reversal in arboreal mammals. *American Zoologist*, 22: 874.
- . 1984. Mechanisms of hind foot reversal in climbing mammals. *Journal of Morphology*, 182:197-219.
- JOHNSON, R. H., AND R. E. W. HALLIWELL. 1968. Natural susceptibility to feline panleucopaenia of the coati-mundi. *Veterinary Record*, 68:582.
- JORGENSEN, P., AND K. H. REDFORD. 1993. Humans and big cats as predators in the Neotropics. *Symposium of the Zoological Society of London*, 65:367-390.
- KAUFMANN, J. H. 1962. Ecology and the social behavior of the coati, *Nasua narica*, on Barro Colorado Island, Panama. *University of California Publications in Zoology*, 60:95-222.
- . 1983. *Nasua narica* (pizote, coati). Pp. 478-480, in *Costa Rican natural history* (D. H. Janzen, ed.). University of Chicago Press, Chicago, 816 pp.
- LACHER, T. E., JR., C. J. R. ALHO, Z. M. S. CAMPOS, AND H. C. GONÇALVES. 1986. Densidades y preferencias de microhábitat de los mamíferos en la Hacienda Nhumirim, sub-región Nhecolandia, pantanal de Mato Grosso del Sur. *Ciencias Interamericana*, 26:30-38.
- LAINSON, R., R. R. BRAGA, A. A. DE SOUZA, M. M. PÓVOA, E. A. Y. ISHIKAWA, AND F. T. SILVEIRA. 1989. *Leishmania (Viannia) shawi* sp. n., a parasite of monkeys, sloths, and procyonids in Amazonian Brazil. *Annales de Parasitologie Humaine et Comparee*, 64:200-207.
- LAYNE, J. N. 1954. The os clitoridis of some North American Sciuridae. *Journal of Mammalogy*, 35:357-367.
- LECLERC-CASSAN, M. 1976. Conditions d'entretien et dominantes pathologiques de quelques carnivores sauvages. *Recueil de Médecine Vétérinaire*, 152:769-779.
- LIAIS, E. 1872. *Climats géologie, faune et géographie botanique du Brésil*. Garnier Frères, Paris, 640 pp.
- LINNAEUS, C. 1766. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Regnum animale. Twelfth ed. Laurentii Salvii, Holmiae, 1:1-824.
- LINS, Z. C., AND M. L. LOPES. 1984. Isolation of *Leptospira* from wild forest animals in Amazonian Brazil. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 78:124-126.
- LOMBARD, L. S., AND E. J. WITTE. 1959. Frequency and types of tumors in mammals and birds of the Philadelphia Zoological Garden. *Cancer Research*, 19:127-141.
- LÖNNBERG, E. 1921. A second contribution to the mammalogy of Ecuador with some remarks on *Caenolestes*. *Arkiv för Zoologi*, 14(4):1-104.
- . 1921-1922. A third contribution to the mammalogy of Ecuador. *Arkiv för Zoologi*, 14(20):1-23.
- MACHADO FILHO, D. A. 1950. Revisão do gênero *Prostenorchis* Travassos, 1915 (Acanthocephala). *Memórias do Instituto Oswaldo Cruz*, 48:495-544.
- MALEK, E. A. 1970. Further studies on mammalian susceptibility to experimental infection with *Heterobilharzia americana*. *Journal of Parasitology*, 56:64-66.
- MARES, M. A., R. A. OJEDA, AND R. M. BARQUEZ. 1989. *Guía de los mamíferos de la Provincia de Salta, Argentina*. University of Oklahoma Press, Norman, 303 pp.
- MARSHALL, L. G., ET AL. 1984. *Mammals and stratigraphy: geochronology of the continental mammal-bearing quaternary of South America*. *Palaeovertebrata, Memoire Extraordinaire*, 1984:1-76.
- MCCLEARN, D. 1985. Anatomy of raccoon (*Procyon lotor*) and coati (*Nasua narica* and *N. nasua*) forearm and leg muscles: relations between fiber length, moment-arm length, and joint angle excursion. *Journal of Morphology*, 183:87-115.
- . 1990. Limb proportions of raccoons (*Procyon*) and coatis (*Nasua*). *American Zoologist*, 30:25.
- . 1992. Locomotion, posture, and feeding behavior of kinkajous, coatis, and raccoons. *Journal of Mammalogy*, 73: 245-261.
- McTOLDRIDGE, E. R. 1969. Notes on breeding ring-tailed coatis. *International Zoo Yearbook*, 9:89-90.
- MICKWITZ, C.-U., v. 1968. Zur Staupe der Kleinbären (Procyoniden). *Kleintier-Praxis*, 13:80-90.
- MILES, M. A., ET AL. 1983. Vertebrate hosts and vectors of *Trypanosoma rangeli* in the Amazon basin of Brazil. *American Journal of Tropical Medicine and Hygiene*, 32:1251-1259.
- MILLER, S., AND J. ROTTMANN. 1976. *Guía para el reconocimiento de mamíferos Chilenos. Expedición a Chile, Santiago*, 200 pp.
- MITCHELL, P. C. 1905. On the intestinal tract of mammals. *Transactions of the Zoological Society of London*, 17:437-536.
- MONDOLFI, E. 1976. Fauna silvestre de los bosques húmedos tropicales de Venezuela. Pp. 113-181, in (L. S. Hamilton, J. Steyermark, J. P. Veillon, and E. Mondolfi, eds.) *Conservación de los bosques húmedos de Venezuela*. Second edition. Sierra Club, Consejo de Bienestar Rural, Caracas, 181 pp.
- . 1987. Baculum of the lesser Andean coati, *Nasuella olivacea* (Gray), and of the larger grison, *Galictis vittata* (Schreber). *Fieldiana: Zoology, New Series*, 39:447-454.
- MYERS, J. G. 1930. Observations on the insect food of the coati (communicated by Prof. Poulton). *Proceedings of the Entomology Society of London*, 5:69-75.
- NÓBREGA, P., AND J. REIS. 1941. Tuberculose em coati (*Nasua narica*) determinada pelo bacilo do tipo bovino. *Arquivos do Instituto Biológico, São Paulo*, 12:303-305.
- NUNES, V. L. B., AND E. T. OSHIRO. 1990. *Trypanosoma (Trypanozoon) evansi* in the coati from the Pantanal region of the Mato Grosso do Sul State, Brazil. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 84:692.
- NUNES, V. L. B., E. T. OSHIRO, M. E. C. DORVAL, L. A. M. GARCIA, A. A. P. DA SILVA, AND A. R. BOGLIOLO. 1993. Investigación epidemiológica sobre *Trypanosoma (Trypanozoon) evansi* no Pantanal Sul-Mato-Grossense. *Estudo de reservatórios*. *Revista Brasileira de Parasitologia Veterinaria*, 2:41-44.
- OLFERS, I. VON. 1818. Bemerkungen zu Illiger's Ueberblick der Säugthiere nach ihrer Vertheilung über die Welttheile, rück-sichtlich der Südamerikanischen Arten (Species). *Abhandlung X. Journal von Brasilien, oder vermischte Nachrichten aus Brasilien, auf wissenschaftlichen Reisen gesammelt von W. L. Eschwege*, 15:192-237.
- OLROG, C. C. 1979. Los mamíferos de la selva húmeda, Cerro Calilegua, Jujuy. *Acta Zoologica Lilloana*, 33:9-14.
- OLROG, C. C., AND M. M. LUCERO. 1981. *Guía de los mamíferos Argentinos*. Ministerio de Cultura y Educación, Fundación Miguel Lillo, Tucumán, 151 pp.
- OSHIRO, E. T., V. L. B. NUNES, L. A. M. GARCIA, A. R. BOGLIOLO, AND A. A. SILVA PEREIRA. 1990. Characterization of *Trypanosoma evansi* from coatis (*Nasua nasua*). *Memórias do Instituto Oswaldo Cruz*, 85:139.
- PANZETTA, P., AND I. M. ALAIMO. 1967. Karyotype of the coati

- (*Nasua nasua solitaria* Schinz). Mammalian Chromosomes Newsletter, 8:97-98.
- . 1969. Estudios citogenéticos en coati, *Nasua nasua solitaria* Schinz Procyonidae, Carnivora. Acta Zoologica Lilloana, 24:157-160.
- PATTON, J. L., B. BERLIN, AND E. A. BERLIN. 1981. Aboriginal perspectives of a mammal community in Amazonian Perú: knowledge and utilization patterns among the Aguaruna Jívaros. Pp. 111-128, in Mammalian biology in South America (M. A. Mares and H. H. Genoways, eds.). Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh, 6:1-539.
- PEREZ, M. D., AND P. T. ARTIGAS. 1970. Infestação experimental de "coati," *Nasua narica* (Mammalia, Procyonidae), pelo *Schistosoma mansoni*. Revista. Faculdade de Farmácia e Bioquímica, Universidade de São Paulo, 8:99-101.
- PETERSON, E. A., W. C. HEATON, AND S. D. WRUBLE. 1969. Levels of auditory response in fissiped carnivores. Journal of Mammalogy, 50:566-578.
- PINE, R. H., S. D. MILLER, AND M. L. SCHAMBERGER. 1979. Contributions to the mammalogy of Chile. Mammalia, 43:339-376.
- POCOCK, R. I. 1921. The external characters and classification of the Procyonidae. Proceedings of the Zoological Society of London, 1921:389-422.
- . 1928. The structure of the auditory bulla in the Procyonidae and Ursidae, with a note on the bulla of *Hyaena*. Proceedings of the Zoological Society of London, 1928:963-974.
- PUBOLS, B. H., JR., W. I. WELKER, AND J. I. JOHNSON, JR. 1965. Somatic sensory representation of forelimb in dorsal root fibers of raccoon, coati mundi, and cat. Journal of Neurophysiology, 28:312-341.
- RADINSKY, L. B. 1981. Evolution and skull shape in carnivores. 2: Additional modern carnivores. Biological Journal of the Linnean Society, 16:337-355.
- REDFORD, K. H., AND J. F. EISENBERG. 1992. Mammals of the Neotropics. The southern cone. University of Chicago Press, Chicago, 2:1-430.
- REDFORD, K. H., AND J. G. ROBINSON. 1987. The game of choice: patterns of Indian and colonist hunting in the Neotropics. American Anthropologist, 89:650-667.
- . 1991. Subsistence and commercial uses of wildlife in Latin America. Pp. 6-23, in Neotropical wildlife use and conservation (J. G. Robinson and K. H. Redford, eds.). University of Chicago Press, Chicago, 520 pp.
- REDFORD, K. H., AND A. M. STEARMAN. 1993. Notas sobre la biología de tres procyonidos simpátricos Bolivianos (Mammalia, Procyonidae). Ecología en Bolivia, 21(November):35-44.
- ROBINSON, N. E. 1982. Some functional consequences of species differences in lung anatomy. Advances in Veterinary Sciences and Comparative Medicine, 26:1-33.
- RUIZ, J. M. 1953. Esquistossomose experimental. 4: *Nasua narica* e *Didelphis paraguayensis*, animais sensíveis à infestação experimental pelo *Schistosoma mansoni*. Memórias do Instituto Butantan, São Paulo, 25(2):23-27.
- SANDERS, R. W., T. F. STUESSY, AND C. MARTICORENA. 1982. Recent changes in the flora of the Juan Fernandez Islands, Chile. Taxon, 31:284-289.
- SANDERSON, I. T. 1949. A brief review of the mammals of Suriname (Dutch Guiana), based upon collection made in 1938. Proceedings of the Zoological Society of London, 119:755-789.
- SATTERFIELD, W. C. 1976. Acid-base parameters—clinical determination and application. American Association of Zoo Veterinarians, Annual Proceedings, 1976:155-163.
- SCHALLER, G. B. 1983. Mammals and their biomass on a Brazilian ranch. Arquivos de Zoologia, São Paulo, 31:1-36.
- SCHINZ, H. R. 1821. Das Thierreich eingetheilt nach dem Bau der Thiere als Grundlage ihre Naturgeschichte und der vergleichenden Anatomie von dem Herrn Ritter von Cuvier, Staatsrath von Frankreich und beständiger Secretär der Academie der Wissenschaften U.S.M.: Aus dem Französischen frei übersetzt und mit vielen Zusätzen versehen von H. R. Schinz. J. S. Gotta, Stuttgart und Tübingen, 1:1-894.
- . 1844. Systematisches Verzeichniß aller bis jetzt bekannten Säugethiere; oder, Synopsis Mammalium nach dem Cuvier'schen System. Solothurn, Jent und Gassmann, 1:1-587.
- SCHMIDT, G. D. 1977. *Oncicola martini* sp. n., and other Archiacanthocephala of the Chaco Boreal, Paraguay. Journal of Parasitology, 63:508-510.
- SCHMIDT, G. D., AND R. L. MARTIN. 1978. Tapeworms of the Chaco Boreal, Paraguay, with two new species. Journal of Helminthology, 52:205-209.
- SEAL, U. S. 1969. Carnivora systematics: a study of hemoglobins. Comparative Biochemistry and Physiology, 31:799-811.
- SEESSEE, F. M., D. E. WORLEY, AND R. L. MARTIN. 1980. A survey of nematode parasites from carnivores of the Chaco Boreal, Paraguay. Pp. 846-858, in Worldwide furbearer conference proceedings. (J. A. Chapman and D. Pursley, eds.). Frostburg, Maryland, 2:1-1552.
- SHANNON, D., A. C. KITCHNER, AND A. MACDONALD. 1995. The preputial gland of the coati, *Nasua nasua*. Journal of Zoology, London, 236:319-357.
- SIMPSON, G. G. 1950. History of the fauna of Latin America. American Scientist, 38:361-389.
- SMITH, C. H. 1842. An introduction to the Mammalia. The naturalist's library. Lizars, Edinburgh, 13:1-313.
- SOIFER, F. 1970. Report of physiological normals committee. American Association Zoo Veterinarians, Annual Proceedings, 1970:120-122.
- SPENCER, J. M., AND D. M. BARNES. 1973. Mycobacteriosis in a coati mundi. Journal of Zoo Animal Medicine, 4(1):15-17.
- STAINS, H. J. 1973. Comparative study of the calcanea of members of the Ursidae and Procyonidae. Bulletin of the Southern California Academy of Science, 72:137-148.
- STANDLEY, S. 1992. The ring-tailed coati. Pp. 143-147, in Management guidelines for bears and raccoons (J. Partridge, ed.). Association of British Wild Animal Keepers, Bristol, 174 pp.
- STEARMAN, A. M. 1990. The effects of settler incursion on fish and game resources of the Yuquí, a native Amazonian society of Eastern Bolivia. Human Organization, 49:373-385.
- STEARMAN, A. M., AND K. H. REDFORD. 1995. Game management and cultural survival: the Yaquí Ethnodevelopment Project in lowland Bolivia. Oryx, 29:29-34.
- STENZEL, P., AND B. BRIMHALL. 1977. Preliminary survey of carnivore hemoglobin compositions: conclusions. Journal of Molecular Evolution, 9:273-278.
- STORR, G. C. C. 1780. Prodrómus methodi mammalium. Litteris Reissimis, Tübingae, 43 pp.
- TAIBEL, A. M. 1958. Presenza di un carattere "concordosessuale" interessante il colore del mantello nel coati *Nasua nasua* (Carnivora, Procyonidae). Zoo Bollettino dei Giardini Zoologici di Milano, Torino, Varallo, 4(2):34-41.
- THOMAS, O. 1901. New neotropical mammals, with a note on the species of *Reithrodon*. Annals and Magazine of Natural History, Series 7, 8:246-255.
- . 1912. Two new species of *Nasua*. Annals and Magazine of Natural History, Series 8, 10:228-230.
- . 1914. New *Nasua*, *Lutra*, and *Proechimys* from South America. Annals and Magazine of Natural History, Series 8, 14:57-61.
- TRAVASSOS DE ROSA, J. F. S., A. P. A. TRAVASSOS DE ROSA, N. DEGALLIER, AND P. F. C. VASCONCELOS. 1992. Caracterização e relacionamento antigénico de três novos *Bunyavirus* no grupo Anopheles A (Bunyaviridae) dos arbovirus. Revista de Saúde pública, São Paulo, 26:173-178.
- TSCHUDI, J. J. VON. 1844-1846. Untersuchungen über die Fauna Peruana. St. Gallen, 1(1):1-262.
- VACEK, Z. 1951. Placenta nosála (*Nasua rufa* L.). Biologické Listy, Supplementum, 2:155-163.
- . 1970. Placenta selem (Placenta of Carnivora). Lynx, 11:32-39.
- VALENZUELA FUENZALIDA, R. 1978. La protección jurídica del patrimonio ambiental de las islas oceánicas Chilenas. Ediciones Universitarias de Valparaíso, Santiago, 89 pp.
- VERLEYE, D. M., C. DIDONATO, AND T. A. FOGLE. 1987. Cytogenetics of coati mundi from the Potawatomi Zoo. Journal of the Indiana Academy of Science, 97:511.
- VIEIRA, C. 1945. Sobre uma coleção de mamíferos de Mato Grosso. Arquivos de Zoologia do Estado de São Paulo, 4:395-430.
- . 1946. Carnívoros do estado de São Paulo. Arquivos de Zoologia do Estado de São Paulo, 5:135-175.
- WAGNER, W. W., JR., ET AL. 1991. Collateral ventilation and pul-

- monary arterial wall thickness in the Central and South American coati. *FASEB Journal*, 5(5):A1430.
- WALLACH, J. D., AND W. J. BOEVER. 1983. Diseases of exotic animals. W. B. Sanders Co., Philadelphia, 1159 pp.
- WEBB, S. D. 1985. Late Cenozoic mammal dispersals between the Americas. Pp. 357–386, in *The great American biotic interchange* (F. G. Stehli and S. D. Webb, eds.). Plenum Press, New York, 532 pp.
- WELKER, W. I., AND G. B. CAMPOS. 1963. Physiological significance of sulci in somatic sensory cerebral cortex in mammals of the family Procyonidae. *Journal of Comparative Neurology*, 120:19–36.
- WEST, R. C. 1993. Warning: do not eat the tarantulas. *Forum of the American Tarantula Society*, 2(1):3–4.
- WIED-NEUWIED, MAXIMILLIAN, A. P., PRINZ VON. 1826. *Beitrage zur Naturgeschichte von Brasilien*, von Maximillian, Prinzen zu Wied. Landes-Industrie-Comptoirs, Weimar, 2:1–616.
- WILSON, D. E., AND D. M. REEDER (EDS.). 1993. *Mammal species of the world: a taxonomic and geographic reference*. Second ed. Smithsonian Institution Press, Washington, District of Columbia, 1206 pp.
- WINDLE, B. C. A., AND F. G. PARSONS. 1897. On the myology of the terrestrial Carnivora. Part I: Muscles of the head, neck, and fore-limb. *Proceedings of the Zoological Society of London*, 1897:370–409.
- . 1898. On the myology of the terrestrial Carnivora. Part II: *Proceedings of the Zoological Society of London*, 1898: 152–186.
- WINGE, H. 1895–1896. *Jordfundne og nulevende Rovdyr (Carnivora) fra Lagoa Santa, Minas Geraes, Brasilien*. E Museo Lundii, Copenhagen, 130 pp.
- WURSTER, D. H., AND K. BENIRSCHKE. 1968. Comparative cytogenetic studies in the order Carnivora. *Chromosoma*, 24:336–382.
- YANOSKY, A. A. 1991. Los mamíferos de la Reserva Privada El Bagual: abundancia, utilización de las comunidades vegetales y factores de riesgo. *Spheniscus*, 9:1–10.
- YANOSKY, A. A., AND C. MERCOLLI. 1992. Preferencias de hábitat y actividad del coati común (*Nasua nasua*) en la Reserva Ecológica el Bagual (Argentina). *Miscellani Zoológica*, 16: 179–182.
- YOST, J. A., AND P. M. KELLEY. 1983. Shotguns, blowguns, and spears: the analysis of technological efficiency. Pp. 189–224, in *Adaptive responses of native Amazonians* (R. B. Hames and W. T. Vickers, eds.). Academic Press, New York, 516 pp.
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